

**FIELD SAMPLING PLAN
FOR THE
RIVER BEND SITE ASSESSMENT
DETROIT, WAYNE COUNTY, MICHIGAN**

Prepared for
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region V

Prepared by
WESTON SOLUTIONS, INC.
Region V Superfund Technical Assessment and Response Team

June 24, 2010

Approved by: _____ Date: _____

U.S. EPA Region V
On-Scene Coordinator

Project Dates of Sampling:	July 06, 2010
CERCLA Site/Spill Identifier No.:	To Be Determined
Contractor Organization:	Weston Solutions, Inc.
Contract Name:	START III
Contract No.:	EP-S5-06-04
Technical Direction Document No.:	S05-0001-1005-034
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ACRONYM LIST

CFR	Code of Federal Regulations
COC	Chain-of-Custody
FSP	Field Sampling Plan
NCP	National Contingency Plan
OSC	On-Scene Coordinator
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
SOP	Standard Operating Procedure
START	Superfund Technical Assessment and Response Team
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedures
TDD	Technical Direction Document
U.S. EPA	United States Environmental Protection Agency
VSP	Visual Sampling Plan
WESTON	Weston Solutions, Inc.
XRF	X-Ray Fluorescence

TABLE OF CONTENTS

Section	Page
ACRONYM LIST	i
TABLE OF CONTENTS	ii
LIST OF TABLES	iii
LIST OF FIGURES	iii
1.0 Introduction.....	1
2.0 Project Management and FSP Distribution and Project Team Member List.....	1
3.0 Planning and Problem Definition.....	2
3.1 Problem Definition.....	2
3.2 Site History and Background.....	2
3.3 Contaminants of Concern/Target Analytes.....	2
4.0 Project Description and Schedule	2
5.0 Project Quality Objectives	3
5.1 Project Objectives	3
5.2 Measurement and Performance Criteria	4
5.3 Data Quality Objectives.....	4
6.0 Sampling Design.....	4
6.1 Sample Collection.....	4
6.2 Sample Numbering System.....	5
6.3 Management of Investigation-Derived Wastes.....	6
7.0 Sampling Procedures	6
7.1 Sampling Standard Operating Procedures	6
7.2 Decontamination Procedures	6
8.0 Sample Handling, Tracking, and Custody Procedures	7
9.0 Field Analytical Methods and Procedures	7
9.1 Field Analytical Methods and SOP.....	7
9.2 Field Testing Laboratory.....	7
9.3 Screening/Confirmatory Analyses	7
10.0 Fixed Laboratory Analytical Methods and Procedures	7
11.0 Quality Control Activities.....	8
11.1 Field Quality Control	8
11.2 Analytical Quality Control.....	8
11.3 Performance Evaluation Samples	8
12.0 Documentation, Records, and Data Management.....	8
13.0 Quality Assurance Assessment and Corrective Actions.....	8
14.0 Reports to Management	8
15.0 Steps 1, 2 and 3: Data Review Requirements and Procedures	9

LIST OF TABLES

Table 1	FSP Revision Form
Table 2	Sample and Analysis Summary

LIST OF FIGURES

Figure 3-1	Site Location Map
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LIST OF ATTACHMENTS

Attachment	Visual Sampling Plan Summary Report
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1.0 Introduction

This Field Sampling Plan (FSP) identifies the data collection activities and associated quality assurance/quality control (QA/QC) measures specific to the River Bend Site, located at the intersection of East Jefferson Avenue and Newport Street in Detroit, Wayne County, Michigan (the Site). All data will be generated in accordance with the quality requirements described in the *Superfund Technical Assessment and Response Team (START) III Generic Quality Assurance Project Plan (QAPP)*, dated June 2006. The purpose of this FSP is to describe site-specific tasks that will be performed in support of the stated objectives. The FSP will reference back to the QAPP for generic tasks common to all data collection activities including routine procedures for sampling and analysis, sample documentation, equipment decontamination, sample handling, data management, assessment and data review. Additional site-specific procedures and/or modifications to procedures described in the *START III Generic QAPP* are described in the following FSP elements.

This FSP is prepared, reviewed, and approved in accordance with the procedures detailed in the *START III Generic QAPP*. Any deviations or modifications to the approved FSP will be documented using **Table 1: FSP Revision Form**.

2.0 Project Management and FSP Distribution and Project Team Member List

Management of the Site will be as documented in the *START III Generic QAPP*. Refer to the *START III Generic QAPP* for an organizational chart, communication pathways, personnel responsibilities and qualifications, and special personnel training requirements.

The following personnel will be involved in planning and/or technical activities performed for this data collection activity. Each will receive a copy of the approved FSP. A copy of the FSP will also be retained in the Site file.

Personnel	Role/Title	Organization	Phone Number	Email
Tricia Edwards	OSC	U.S. EPA	734-740-9016	Edwards.Tricia@epa.gov
Lori Kozel	Project Manager	START	313-739-2527	Lori.Kozel@westonsolutions.com
Matthew Beer	Project Lead/Field Safety Officer	START	313-739-2539	Matthew.beer@westonsolutions.com
Steve Kidder	Field Personnel	START	517-381-5949	Steven.Kidder@westonsolutions.com
Tonya Balla	Health and Safety	START	847-528-2623	Tonya.Balla@westonsolutions.com
Lisa Graczyk	QA Reviewer	START	312-424-3339	lgraczyk@dynamac.com

Notes:

OSC – On-Scene Coordinator

QA – Quality Assurance

START – Superfund Technical Assessment and Response Team

U.S. EPA – United States Environmental Protection Agency

3.0 Planning and Problem Definition

3.1 Problem Definition

The United States Environmental Protection Agency (U.S. EPA) tasked Weston Solutions, Inc. (WESTON®) START to perform a site assessment at the Site. The Site is the River Bend Site, located in Detroit, Michigan. The U.S. EPA identified possible heavy metals and asbestos within the soils at the Site.

U.S. EPA will conduct a site assessment to investigate the conditions on Site that could pose an imminent threat to human health, welfare, and the environment.

3.2 Site History and Background

The Site is located at the intersection of East Jefferson Avenue and Newport Street (Figure 3-1). The Site's approximate geographical coordinates are 42°22'16" North latitude and 82°56'50" West longitude. The Site is currently an open grassy lot with no buildings or structures upon it. Historical aerial images show that no structures, at the very least, have been at the Site since 1999. The property is bordered to the North by East Jefferson Avenue and commercial and residential properties, to the South by Freud Street and residential properties, to the East by Newport Street and residential properties, and to the West by Piper Boulevard and a commercial property. The Site has no perimeter fencing or obstructions to deter people or wildlife from entering the property and a school is located 0.2 miles southwest of the Site.

On May 25, 2010, U.S. EPA, START, and the City of Detroit conducted a windshield survey of the property and observed the current status of the Site. The site is currently a vacant parcel with vegetation and no buildings. Two outdoor electrical transformers were identified and city sewers are located throughout the Site.

3.3 Contaminants of Concern/Target Analytes

The contaminants of concern at the Site include but are not limited to heavy metals and asbestos which are present in soil. WESTON START will collect up to ten soil samples for laboratory analysis to determine the level of contaminants and potential hazardous waste characteristics of the soil. Based on field observations and x-ray fluorescence (XRF) readings, soil samples may be collected and analyzed for:

- Toxicity Characteristic Leaching Procedure (TCLP) Metals; and
- Target Analyte List (TAL) Metals;.

Based on site observations, additional samples may be collected for asbestos analysis.

4.0 Project Description and Schedule

The site assessment will consist of tasks necessary to document and characterize threats posed to human health and the environment at the Site. Specifically the following tasks will be performed:

- Site reconnaissance, including photo and written documentation of site conditions and potential hazardous waste.
- Use of U.S. EPA's Visual Sampling Plan (VSP) software to establish the number and locations of soil samples necessary to identify heavy metal contaminants with a specified level of confidence.
- XRF screening at various locations throughout the Site to field screen for heavy metals in soil.
- Sample Site surface soil (0-3 inches) at locations where XRF metal results are elevated or visual observations indicate the need for laboratory analysis.

A commercial laboratory will be utilized for analytical services. WESTON START will provide sample coordination including laboratory procurement and sample shipment. Sample labels and chain of custody (COC) paperwork will be generated by WESTON START. Samples will be packaged properly by WESTON START and shipped by overnight courier, or transported directly to the laboratory. The turn-around time for the sample data will be 10 business days. The sample results will be reviewed and validated by a WESTON START chemist within 2 weeks of data receipt from the laboratory.

The sampling design is provided below in Section 6.0.

U.S. EPA and WESTON START will begin the site assessment on Tuesday, July 06, 2010. The site assessment is expected to take one day.

5.0 Project Quality Objectives

5.1 Project Objectives

The objective of sampling activities is to determine if the concentrations of contaminants in the soil pose a threat to human health and the environment.

The objectives for this investigation include:

- Identify the constituents and characteristic properties of soil at the Site;
- Determine if a removal action is warranted based on National Contingency Plan (NCP) criteria and, if so, whether the response should be classified as emergency, time-critical, or non time critical;
- Rapidly assess and evaluate the urgency, magnitude, extent, and effects of a release, or threatened release, of hazardous substances, pollutants or contaminants identified and their affects on human health and/or the environment;

- Supply the Agency for Toxic Substances and Disease Registry or others with information about the nature and magnitude of any health threats associated with the identified threats;
- Support subsequent public health advisories; and
- Determine a remedy to eliminate, reduce, or control risks to human health and the environment and to support an Action Memorandum documenting the identified removal approach.

5.2 Measurement and Performance Criteria

Generic measurement and performance criteria described in the *START III Generic QAPP* will be used to ensure that data are sufficiently sensitive, precise, accurate, and representative to support site decisions.

5.3 Data Quality Objectives

Data quality objectives address requirements that include when, where, and how to collect samples, the number of samples, and the limits on tolerable error rates. These steps should periodically be revisited as new information about a problem is learned. Sections 4.0 and 6.0 address these objectives.

In addition, data quality objectives address the analytical screening levels to be used to make decisions. The soil sampling results for TCLP Metals will be compared to the hazardous waste criteria outlined in 40 Code of Federal Regulations (CFR), 261.24 to determine whether an emergency response is needed pursuant to 40 CFR 300.415. Target analyte list (TAL) Metals and results from the XRF will be compared to the Michigan Department of Natural Resources and Environment (MDNRE) Part 201 Residential Direct Contact criteria or other criteria as deemed appropriate. Asbestos sample results will be evaluated based on the percentage and type of fibers identified.

6.0 Sampling Design

WESTON START will perform the Site activities detailed in the following subsections.

6.1 Sample Collection

WESTON START will utilize the sampling design that was generated by the VSP software for the site to identify the XRF screening and potential sample locations. The VSP software identified four sampling locations to identify a hotspot of a 50-foot radius with a 95 percent probability. The Attachment contains the VSP software results. Figure 2 shows the proposed sampling locations. The XRF tool will be used to screen the surface at each pre-determined location. A shovel and/or plastic scoop will be utilized to remove any vegetation or debris and create a flat surface in order to collect an accurate XRF reading. Sixty-seven XRF screenings will be collected from the site.

Based on the XRF screening results, WESTON START will collect surface soil samples from the Site. The locations of the samples will be determined in the field based on elevated levels on the XRF. Surface soil samples will be collected from 0 to 3 inches below grade at each selected location and will be submitted for laboratory analysis and analyzed for TCLP metals and TAL Metals. A 10 business day turnaround time will be required from the laboratory.

No background, extent of contamination (of the native soil), nor confirmation samples will be collected as part of this sampling activity. The samples will be collected to verify the presence of metal contamination (and possibly asbestos) at the Site. Additional biased screening may be conducted at the discretion of the OSC – which may include non-vegetated areas and/or suspect contaminated areas. Samples for asbestos will be collected based on visual observations.

Soil samples will be collected from the soil on Site. The sample locations will be clearly marked using a pin-flag. A clean stainless-steel or disposable plastic scoop will be used to collect the soil samples. The sample containers will be filled directly from the soil sampling scoop provided the soil appears homogenous. If the soil does not appear reasonably homogenous; then the soil gathered for the sample will be homogenized inside a plastic baggie prior to filling the laboratory-supplied jar; and any large debris fragments will be removed. Up to ten soil samples and one duplicate sample will be collected and analyzed for TCLP Metals, TAL Metals, and asbestos.

The sample container, volume, and preservation requirements are presented in **Table 2: Sampling and Analysis Summary**.

6.2 Sample Numbering System

All samples for XRF screening and analysis, including QC samples, will be given a unique sample number. The sample numbers will be recorded in the field logbook and logged by the RAT software.

WESTON START will assign each sample a project sample number. The project sample number highlights the suspected contaminated area and location, and will be used for documentation purposes in field logbooks, as well as for presentation of the analytical data in memoranda and reports. The project sample numbering system will be composed of the components below.

Project Identifier

The first part of the project sample numbering system will be the three-character designation RIV to identify the sampling site, the River Bend Site.

Sequence Identifier

This shall consist of a two-digit sequence number that tracks the number of samples collected

from the Site for a particular matrix. Sequence 01 refers to the first sample, and sequence 02 refers to the second sample, and so on.

Sample Date

This shall consist of a six digit date. For example, "063010" for June 30, 2010. Duplicate samples will include "D" at the end of the six digit date.

Examples of the sample identifications for the Site are as follows:

- RIV-01-070710: First surface soil sample collected from the River Bend Site on July 7, 2010
- RIV-03-070710D: Duplicate of third surface soil sample collected from the River Bend Site on July 7, 2010.

6.3 Management of Investigation-Derived Wastes

For purposes of this FSP, investigation-derived wastes are defined as any byproduct of the field activities that is suspected or known to be contaminated with hazardous substances. The performance of field activities will produce waste products, such as spent sampling supplies (e.g., scoops, zip-lock bags), and expendable Personal Protective Equipment (PPE). All waste generated during the site assessment will be placed in trash bags and disposed of. Although not anticipated, if non dedicated sampling equipment (e.g., bucket auger) is used for sample collection, decontamination water will be generated. All decontamination water generated during the site assessment will be stored in drums or five-gallon buckets and left on-site in a staging area with U.S. EPA approval. If required, disposal arrangements will be executed in accordance with appropriate local, state, or federal regulations. WESTON START will refer to the U.S. EPA's *Management of Investigation-Derived Wastes During Site Inspections* (U.S. EPA, 1991) guidance on off-site disposal policies, if this action is deemed necessary.

7.0 Sampling Procedures

7.1 Sampling Standard Operating Procedures

The following WESTON Standard Operating Procedures (SOP) will be used during the site evaluation:

- SOP003 – Removal Assessment
- SOP101 – Logbook Documentation
- SOP102 – Field Notes
- SOP103 – Chain-of-Custody Documentation
- SOP104 – Photographic and Video Documentation
- SOP301 – Decontamination Procedures
- SOP 302 – Surface Soil Sampling

7.2 Decontamination Procedures

General decontamination procedures are described in Section B.2 of the *START III Generic QAPP*.

The following standard decontamination protocols will be used:

- All disposable sampling supplies and PPE will be bagged and sealed. If left on site, the trash bag will be labeled identifying the contents.

8.0 Sample Handling, Tracking, and Custody Procedures

All samples will be identified, handled, shipped, tracked, and maintained under COC, in accordance with *START III Generic QAPP* Section B.3.

9.0 Field Analytical Methods and Procedures

9.1 Field Analytical Methods and SOP

Field analytical methods will not be employed during the site assessment. All analytical methods will be performed by a commercial laboratory and are presented in Table 2 of this report.

9.2 Field Testing Laboratory

A field testing laboratory will not be used during the site assessment.

9.3 Screening/Confirmatory Analyses

XRF screening will be used when sampling surface soil to assist in identification of sample locations. All samples will be sent to the laboratory for characterization.

10.0 Fixed Laboratory Analytical Methods and Procedures

U.S. EPA-certified commercial laboratories will be used. The laboratory name, address, contact person, telephone number, and fax number are as follows:

Tri Matrix Laboratories
5560 Corporate Exchange Court
Grand Rapids, Michigan 49512
616.846.9528
616.846.9541 Fax
Contact: Lisa Harvey

EMSL Analytical
2001 E. 52nd Street
Indianapolis, Indiana 46205
866.736.4824
317.803.3047
Contact: Paul Viemann

The analytical methods are detailed in Table 2 of this FSP.

11.0 Quality Control Activities

11.1 Field Quality Control

Field QC samples will be collected and analyzed for this project at the frequency described in *START III Generic QAPP*, Table 4. The number of QC samples collected for each analytical parameter and concentration level are listed in **Table 2: Sampling and Analysis Summary**.

11.2 Analytical Quality Control

QC for analytical procedures will be performed at the frequency described in *START III Generic QAPP*, Tables 5 and 6. In addition, method-specific QC requirements will be used to ensure data quality.

11.3 Performance Evaluation Samples

Performance evaluation samples will not be collected during this sampling event.

12.0 Documentation, Records, and Data Management

Documentation, record keeping, and data management activities will be conducted in accordance with the *START III Generic QAPP*, Section B.10.

13.0 Quality Assurance Assessment and Corrective Actions

No field audits will be conducted due to the short-term (one day) sampling activity.

14.0 Reports to Management

Reports to management will be written and distributed in accordance with the *START III Generic QAPP*, Section C.

15.0 Steps 1, 2 and 3: Data Review Requirements and Procedures

Step 1: Data collection activities, including sample collection and data generation, will be verified in accordance with the *START III Generic QAPP*, Section D.

Step 2: Data will be validated in accordance with the *START III Generic QAPP*, Section D. A WESTON START chemist will validate the data.

Step 3: Data will be reviewed for usability in accordance with the *START III Generic QAPP*, Section D.

TABLES

Table 1 **FSP Revision Form**

Site: River Bend Site, Detroit, Wayne County, Michigan

OSC: Tricia Edwards

TDD: S05-0001-1005-034

Date	Rev. No.	Proposed Change to FSP/QAPP	Reason for Change of Scope/Procedures	FSP Section Superseded	Requested By	Approved By

Table 2
Sampling and Analysis Summary

Site: River Bend Site, Detroit, Wayne County, Michigan

OSC: Tricia Edwards

TDD: S05-0001-1005-034

Matrix	Analytical Parameter	Analytical Method (SW-846)	Containers (Numbers, Size, and Type)	Preservation Requirements	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSD Pair or Spike / Duplicates	No. of VOA Trip Blanks	No. of Equip./ Rinsate Blanks	Total No. of Samples to Lab
Soil	TCLP Metals	1311/6010B/7470A	8-ounce glass jar	Ice, Cool to 4°C	10	1	1	0	0	11
	TAL Metals	6010B/7471A	4-ounce glass jar	Ice, Cool to 4°C	10	1	1	0	0	11
	Asbestos	CARB 435 /Method 600/R-93/116	Ziploc bag	None	10	1	0	0	0	11

Notes:

°C – Degrees Celsius

Equip. – Equipment

No. – Number

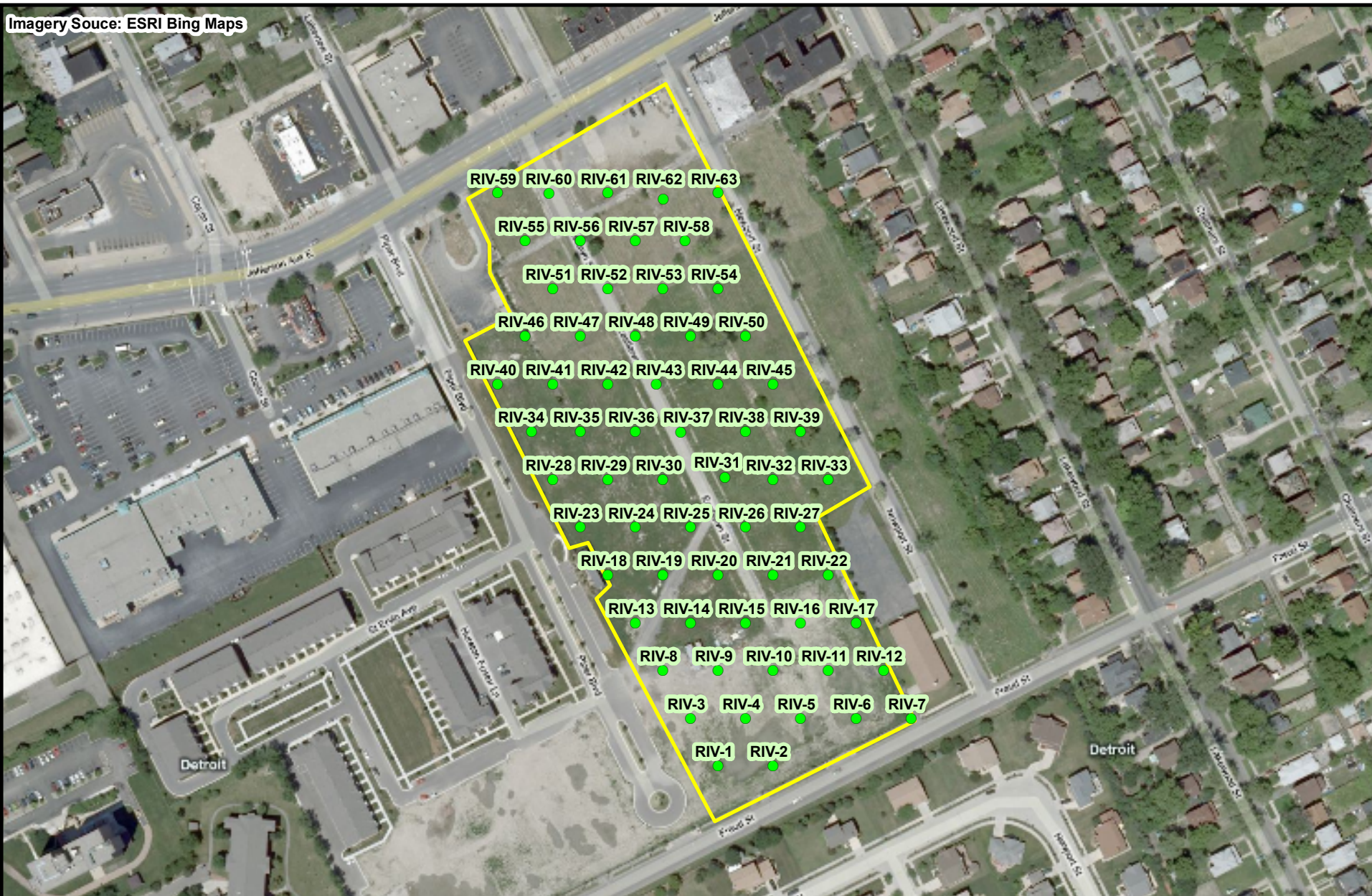
Oz. – Ounce

TCLP – Toxicity Characteristic Leaching Procedure

TAL – Total Analyte List

FIGURES

Imagery Source: ESRI Bing Maps



Legend

- Sampling Locations
- Property Boundary

0 225 Feet



Prepared For:
U.S. EPA REGION V

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DCN: 1067-2A-AHLB



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Figure 3-1
Sampling Location Map
River Bend SA
Detroit, Wayne County, Michigan

ATTACHMENT

VISUAL SAMPLING PLAN SUMMARY REPORT

Systematic sampling locations for detecting an area of elevated values (hot spot)

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (e.g., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Detect the presence of a hot spot that has a specified size and shape
Type of Sampling Design	Hot spot accounting for false negatives
Sample Placement (Location) in the Field	Systematic (Hot Spot) with a random start location
Formula for calculating number of sampling locations	Algorithm developed by Sego and Wilson (2007)
Input number of samples	67
Type of samples	Point Samples
Number of samples on map ^a	67
Number of selected sample areas ^b	1
Specified sampling area ^c	466816.04 ft ²
Grid pattern	Triangular
Size of grid / Area of grid ^d	90.0879 feet / 7028.51 ft ²
Total cost of sampling ^e	\$34,500.00

^a This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.

^b The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.

^c The sampling area is the total surface area of the selected colored sample areas on the map of the site.

^d Size of grid / Area of grid gives the linear and square dimensions of the grid spacing used to systematically place samples.

^e Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1

X Coord	Y Coord	Label	Value	Type	Historical
13507111.1127	319816.8712			Hotspot	
13507201.2006	319816.8712			Hotspot	
13507066.0687	319894.8896			Hotspot	
13507156.1566	319894.8896			Hotspot	
13507246.2445	319894.8896			Hotspot	
13507336.3324	319894.8896			Hotspot	
13507426.4203	319894.8896			Hotspot	
13507021.0248	319972.9080			Hotspot	
13507111.1127	319972.9080			Hotspot	
13507201.2006	319972.9080			Hotspot	
13507291.2885	319972.9080			Hotspot	
13507381.3764	319972.9080			Hotspot	
13506975.9808	320050.9264			Hotspot	
13507066.0687	320050.9264			Hotspot	
13507156.1566	320050.9264			Hotspot	
13507246.2445	320050.9264			Hotspot	
13507336.3324	320050.9264			Hotspot	
13506930.9369	320128.9448			Hotspot	
13507021.0248	320128.9448			Hotspot	
13507111.1127	320128.9448			Hotspot	
13507201.2006	320128.9448			Hotspot	
13507291.2885	320128.9448			Hotspot	
13506885.8930	320206.9632			Hotspot	
13506975.9808	320206.9632			Hotspot	
13507066.0687	320206.9632			Hotspot	
13507156.1566	320206.9632			Hotspot	
13507246.2445	320206.9632			Hotspot	
13506840.8490	320284.9816			Hotspot	
13506930.9369	320284.9816			Hotspot	
13507021.0248	320284.9816			Hotspot	
13507111.1127	320284.9816			Hotspot	
13507201.2006	320284.9816			Hotspot	
13507291.2885	320284.9816			Hotspot	
13506795.8051	320363.0000			Hotspot	
13506885.8930	320363.0000			Hotspot	
13506975.9808	320363.0000			Hotspot	
13507066.0687	320363.0000			Hotspot	
13507156.1566	320363.0000			Hotspot	
13507246.2445	320363.0000			Hotspot	

13506750.7611	320441.0184		Hotspot	
13506840.8490	320441.0184		Hotspot	
13506930.9369	320441.0184		Hotspot	
13507021.0248	320441.0184		Hotspot	
13507111.1127	320441.0184		Hotspot	
13507201.2006	320441.0184		Hotspot	
13506795.8051	320519.0368		Hotspot	
13506885.8930	320519.0368		Hotspot	
13506975.9808	320519.0368		Hotspot	
13507066.0687	320519.0368		Hotspot	
13507156.1566	320519.0368		Hotspot	
13506840.8490	320597.0552		Hotspot	
13506930.9369	320597.0552		Hotspot	
13507021.0248	320597.0552		Hotspot	
13507111.1127	320597.0552		Hotspot	
13506795.8051	320675.0736		Hotspot	
13506885.8930	320675.0736		Hotspot	
13506975.9808	320675.0736		Hotspot	
13507066.0687	320675.0736		Hotspot	
13506750.7611	320753.0920		Hotspot	
13506840.8490	320753.0920		Hotspot	
13506930.9369	320753.0920		Hotspot	
13507021.0248	320753.0920		Hotspot	
13507111.1127	320753.0920		Hotspot	
13506885.8930	320831.1104		Hotspot	
13506975.9808	320831.1104		Hotspot	
13507066.0687	320831.1104		Hotspot	
13507021.0248	320909.1288		Hotspot	

Primary Sampling Objective

The primary purpose of sampling at this site is to detect "hot spots" (local areas of elevated concentration) of a given size and shape with a specified probability, $1-\beta$.

Selected Sampling Approach

This sampling approach requires systematic grid sampling with a random start. If a systematic grid is not used, the probability of detecting a hot spot of a given size and shape will be different than desired or calculated.

Number of Total Samples: Calculation Equation and Inputs

The algorithm used to calculate the probability of a hit (which makes possible the calculation of the hot spot size or the number of samples) was developed by Sego and Wilson (2007), which builds upon the approach of Singer and Wickman (1969). Gilbert (1987) also discussed hotspot sampling designs. Inputs to the algorithm include the radius of the circular hot spot of interest, an acceptable probability of finding a hot spot, the false negative error rate, the desired type of sampling grid, and the sampling budget. For this design, the grid size was calculated based on the given circular hot spot size and other parameters.

The inputs to the algorithm that result in the grid size are:

Parameter	Description	Value
-----------	-------------	-------

Inputs		
1- β	Probability of detection	95%
η	False negative error rate	5%
Grid Type	Grid pattern (Square, Triangular or Rectangular)	Triangular
Hot Spot Size	Radius of hot spot	50 feet
Hot Spot Area ^a	Area of hot spot ($\text{Radius}^2 * \pi$)	7853.98 ft ²
Sampling Area	Total area to sample	466816.04 ft ²
Outputs		
Grid Size	Spacing between samples	90.0879 feet
Grid Area	Area represented by one grid	7028.51 ft ²
Samples ^b	Optimum number of samples	66.4175

^a Radius of the hot spot is used by the algorithm. Hot spot area is provided for informational purposes.

^b The optimum number of samples is calculated by dividing the sampling area by the grid area.

Assumptions that Underlie the VSP Locating a Hot Spot Design Method

1. The shape of the hot spot of concern is circular.
2. The level of contamination that defines a hot spot is well defined.
3. The location of the hot spot is unknown, and if a hot spot is present, all locations within the sampling area are equally likely to contain the hot spot.
4. Samples are taken on a square, rectangular or triangular grid pattern.
5. Each sample is collected, handled, measured or inspected using approved methods that yield unbiased and sufficiently precise measurements.
6. A very small proportion of the surface being studied will be sampled (the sample is much smaller than the hot spot of interest).
7. Sample locations are independent of the measurement process.
8. The systematic grid is placed at a randomly determined starting place to cover the surface area of interest.
9. There are no false positives (a clean area is not mistakenly identified as a hot spot).
10. The false negative error rate is known and is the same for all measurements.

For quantitative samples, the false negative error rate is the probability that a sample measurement indicates that contamination is below the acceptable threshold, when, in fact, it is at or above the threshold. For presence/absence measurements, the false negative error rate is the probability the sample does not detect contamination when it is present.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is \$34,500.00, which averages out to a per sample cost of \$514.93. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	Per Analysis	Per Sample	67 Samples
Field collection costs		\$100.00	\$6,700.00
Analytical costs	\$400.00	\$400.00	\$26,800.00
Sum of Field & Analytical costs		\$500.00	\$33,500.00
Fixed planning and validation costs			\$1,000.00
Total cost			\$34,500.00

Recommended Data Analysis Activities

Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2006).

The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

A map of the actual sample locations will be generated so that the sampling plan and the field implementation may be compared. Deviations from planned sample locations due to topographic, vegetative, or other features will be noted. Their impacts will be qualitatively assessed. If a hot spot is discovered, additional sampling may be performed to determine its size and shape, in which case, the initial assumptions of the sampling design may then be assessed and/or reconsidered.

References

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